Title: Pool Time

Brief Overview:

In this performance based assessment, students will integrate problem solving with real-world application as they explore pool designs. Students will make conjectures, and validate their thinking based on their knowledge of geometric concepts. Students will apply communication skills by writing a note about their discoveries. This unit may be used as an instructional resource or a summative assessment.

Links to NCTM Standards:

- **Mathematics as Problem Solving**
  Students will demonstrate their ability to solve problems in mathematics including problems with real-world application involving geometric concepts.

- **Mathematics as Communication**
  Students will demonstrate their ability to communicate mathematically using appropriate vocabulary as they explain their reasoning and justify their solutions. Students will reflect on their explorations and create an informative note.

- **Mathematics as Reasoning**
  Students will demonstrate their ability to reason mathematically using models, geometric properties, and prior knowledge to validate their thinking.

- **Mathematical Connections**
  Students will integrate mathematical problem solving with real-life architectural situations given specifications.

- **Geometry and Spatial Sense**
  Students will demonstrate symmetry and apply this concept to the solution of real-world problem solving situations. Students will classify, describe, and draw geometric shapes.

- **Measurement**
  Students will identify angles greater than a right angle and use square units to determine area.

Grade/Level:

Grade 3

Duration:

Five class sessions (60 minutes each)

Prerequisite Knowledge:

Students should have working knowledge of the following skills:

- Regular polygons
- Closed curved paths
- Time
- Area

- Right angles
- Writing a note

Objectives:

Students will:

- work cooperatively to solve an authentic problem.
- sort a collection of shapes based on known attributes.
- construct a pool design according to specifications.
- identify congruent figures and lines of symmetry.
- construct a design using mirror symmetry.
- compute elapsed time.
- identify angles equal to and greater than a right angle.

Materials/Resources/Printed Materials:

- Student Resources # 1-5 (packet)
- Teacher Resources # 1
- "The Robin and the Worm(s)" from Poems to Count On by Sandra Liatsos
- Protractor, ruler, calculator
- Post-its or 3"x3" colored squares
- Chart paper
- Chalk/ markers
- Pattern blocks
- Dot paper

Performance Assessment - Development/Procedures:

Day 1:

- Motivate and review geometric shapes by presenting each cooperative groups of 3 or 4 with one copy of Student Resource Sheet #1. Have shapes cut out and sorted into at least five different sets. (concave, triangles, parallelograms, curved edges, right angles) Discuss common attributes for each set of sorted shapes. List mathematical vocabulary as elicited on chart paper, chalkboard, or a "Word Wall" for future reference.
- Discuss prior knowledge of the beach or pool. (A Venn diagram may be helpful.) Ask questions like "Who has been to a beach? What did you like about it? Do you have a pool in your neighborhood or backyard? Do you have an in-ground or above ground pool? How is a pool like a beach?
- Distribute the Student Resource packet of performance tasks. Read the vignette for Task 1 aloud as students read silently.

> Temperatures last summer were so high that Earl's family practically lived at the beach. Mr. Hurt, Earl's father, enjoyed hauling the family off to the shore every weekend, but he thought he could save more money this year if he had an in-ground pool constructed right in his own backyard. The whole family was excited, especially Earl! Now he could invite his best friend Mark over for a swim. Mr. Hurt's architect bought four blueprint designs of the new pool to be considered by the family.
>
> Study the designs below. Then complete Steps A-C on your own.

- Have students work independently to complete the task.
- Have students share their responses with the class.

Day 2:

- Read the poem "The Robins and the Worm(s)" from Poems to Count On by Sandra Liatsos. Ask students to tell what is wrong with the statement: " He got the bigger half." Explain that the first half of something is always exactly the same as the second half.
- Distribute a Post-it or a 3"x3" colored square to each student. Have students to fold the square in half. Discuss congruency and symmetry of each half. Have students to find other ways to fold and show half of the square. After all lines of symmetry (creases) have been explored, have students to count and share their discoveries with the class.
- Read the vignette for Task 2 aloud as students read silently.

> Mr. Hurt did not like any of the original designs provided by his architect. Instead the family decided to design their own pool. Each family member had to submit a design to be considered by everyone. Mr. Hurt gave the following specifications for the pool design:
>
> ☐ no more then two geometric shapes
>
> ☐ at least one line of symmetry
>
> ☐ an area not greater than 20 square units
>
> ☐ creative and visually attractive
>
> Use the specifications above to construct your pool design in the grid below. After you have finished your design, put a check in each box if it has that attribute.

- Have students complete Task 2 independently.
- Have students share their designs with the class.

Day 3

- Motivate and review mirror symmetry. Have pairs of students to work together. One student will draw a vertical line in the center of a sheet of paper. The other student will construct a geometric design using pattern blocks that touch the center of the vertical line. Have the partner to construct the mirror image of the first pattern. Have students to transfer their designs to dot paper and share work with the class. (You may wish to have students to color their designs.) Discuss the symmetrical designs and ask questions to clear any misunderstandings.

- Read the vignette for Task 3 aloud as students read silently.

> Mr. Hurt's family agreed on the pool design below. When his next door neighbor saw the design, she wanted a pool constructed exactly like his on the other side of the fence.
>
> Study the design of the new pool. In the grid complete part B of the illustration by drawing the neighbor's pool as a mirror image of his own. Then complete Step B.

- Have students complete Task 3 independently.
- Have students share their symmetrical pool designs and explanations.

Day 4

- Motivate and review the concept of elapsed time by asking questions, such as: What time did you get up today? What time did you leave your home for school? (How long did it take to prepare to come to school?) What time did you leave for school? What time did you arrive at school? (How long did it take to get to school?) Have groups of three students to prepare a series of three time related questions like those previously asked. Have the set of questions traded with another group in the class and the elapsed time calculated with pencil and paper or calculators.

- Read the vignette for Task 4 aloud as students read silently.

  When contractors began construction of Mr. Hurt's pool, it took several days to dig the hole before concrete could be poured. On Saturday, bulldozers began digging at 8:30 in the morning. Mr. Hurt had to leave for a dentist appointment at 10:45 a.m.

- Have students complete Task 4 independently.
- Have students share their responses and explanations.

Day 5

- Review the format for writing a note and the acronym **FATP**. (**F**orm, **A**udience, **T**opic, **P**urpose)
- Read aloud the writing prompt for Task 5 as students read silently.

  Now that the pool has been completed, it's time to have some fun! Use the information gathered from Tasks 1-4 to describe your new pool to a best friend. Then invite him or her to your long awaited pool party. Think about the day and date the party will take place. Think about the time it will begin and end. Finally, think about how long the party will last.

- Have students complete their notes. After following the writing process, have students share their notes with the class.

Performance Assessment:

This performance based assessment may be administered in its entirety to culminate the unit.

Extension/Follow Up:

Have students:

- find the perimeter of each pool.
- compute the cost for constructing each pool given the cost per square unit.
- learn more about concave and convex polygons.
- develop a time schedule of daily activities and compute the elapsed time between events.
- plan and have a pool party at the nearest facility which includes those components discussed in the note.

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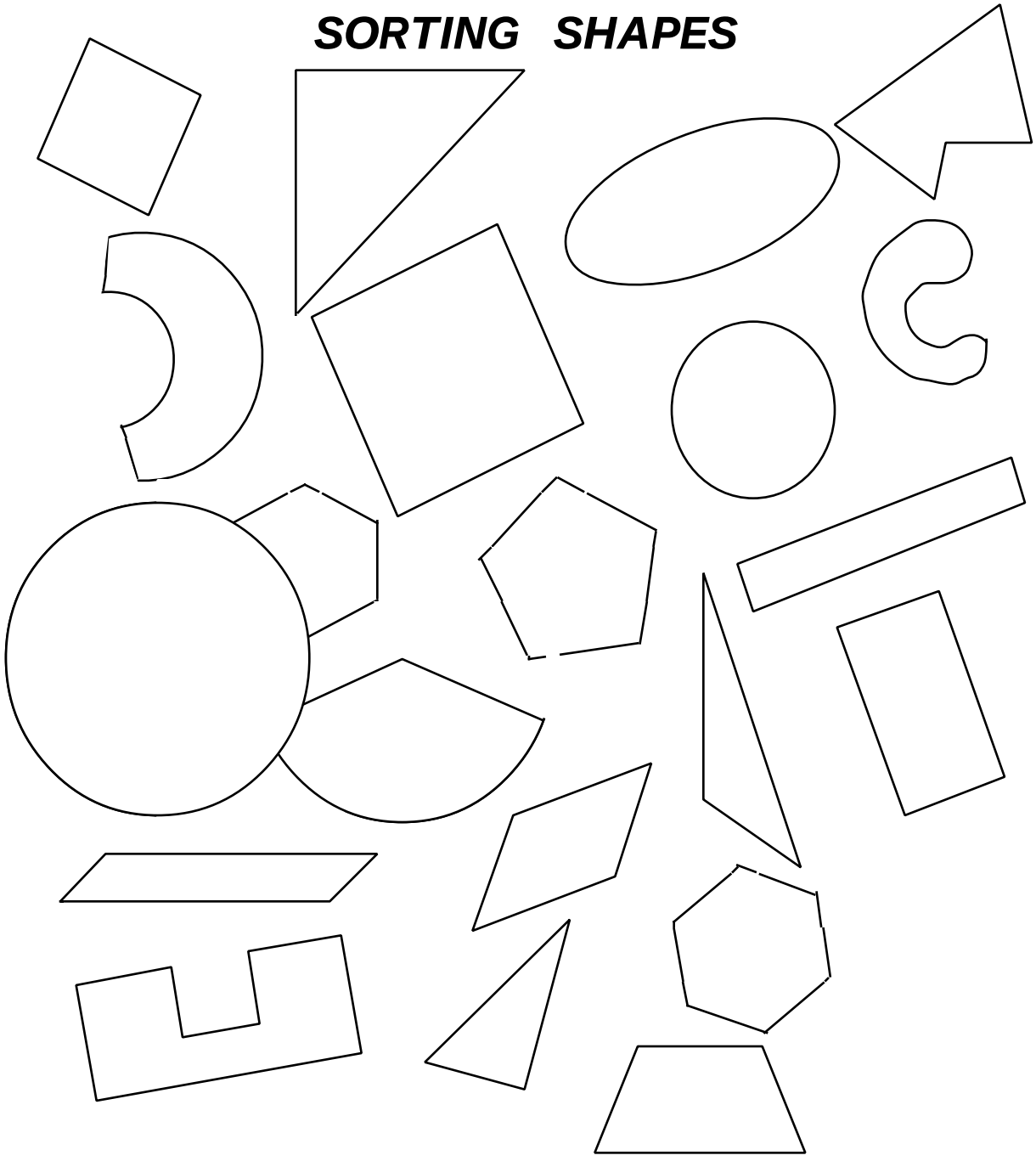
SORTING SHAPES



Adapted from Elementary School Mathematics by John Van de Walle

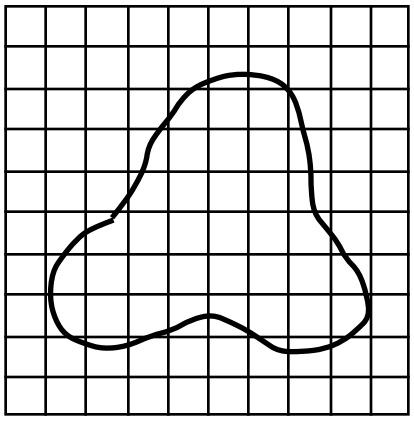
Name:_____ Date:_____

TASK 1 POOL TIME GRADE 3

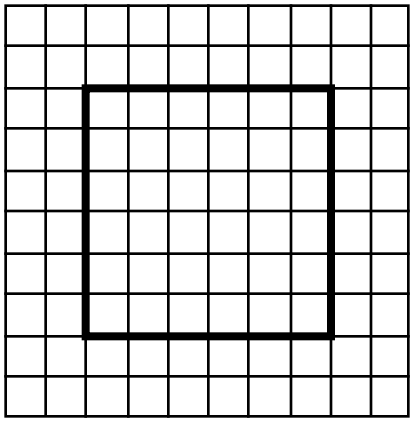
Temperatures last summer were so high that Earl's family practically lived at the beach. Mr. Hurt, Earl's father, enjoyed hauling the family off to the shore every weekend, but he thought he could save more money this year if he had an in-ground pool constructed right in his own backyard. The whole family was excited, especially Earl! Now he could invite his best friend Mark over for a swim. Mr. Hurt's architect bought four blueprint designs of the new pool to be considered by the family.

Study the designs below. Then complete Steps A-C on your own.

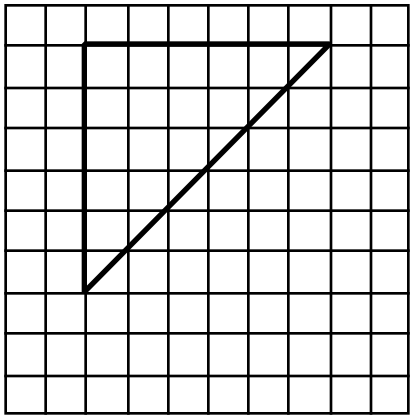
A



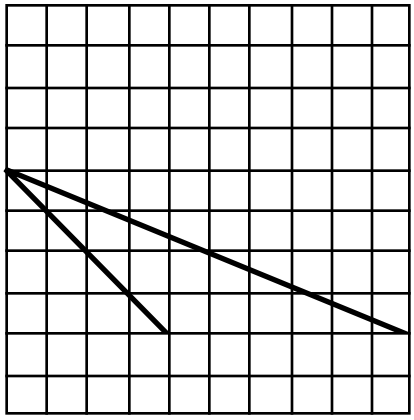
B



C



D



STEP A Which pool is a closed curved path?_____

STEP B What geometric shape is created by pool B?_____

How many right angles does it have? _____

Explain how you decided._____

_____

_____

_____

STEP C Which pool contains an angle greater than one of the right angles found in pool B?_____

Explain how you decided._____

_____

_____

_____

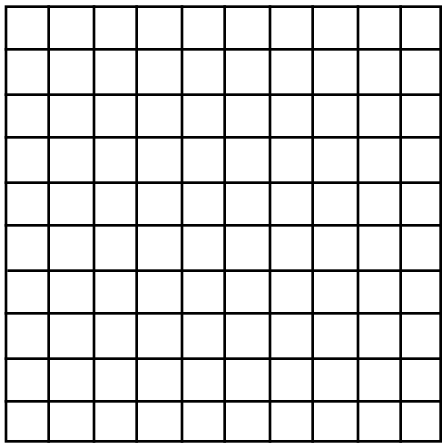
Task 2

Mr. Hurt did not like any of the original designs provided by his architect. Instead the family decided to design their own pool. Each family member had to submit a design to be considered by everyone. Mr. Hurt gave the following specifications for the pool design:

- ☐ no more then two geometric shapes
- ☐ at least one line of symmetry
- ☐ an area not greater than 20 square units
- ☐ creative and visually attractive

Use the specifications above to construct your pool design in the grid below. After you have finished your design, put a check in each box if it has that attribute.

STEP A Draw your pool.



STEP B Now, review your pool design. Put a check in the box if your design meets Mr. Hurt's specifications.

STEP C Write a paragraph of at least five sentences explaining how you used the specifications to create your design.

_____

_____

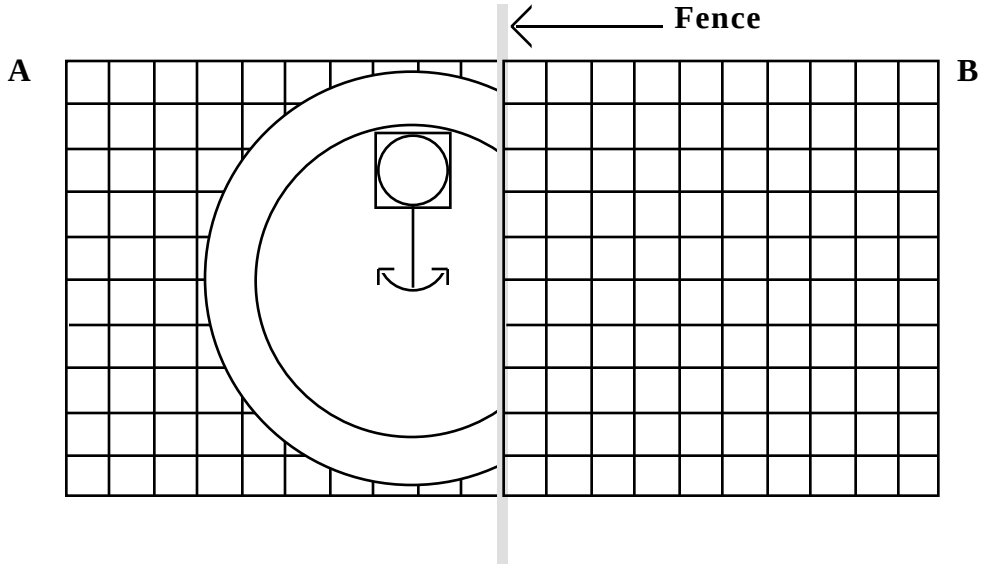
_____

Task 3

Mr. Hurt's family agreed on the pool design below. When his next door neighbor saw the design, she wanted a pool constructed exactly like his on the other side of the fence.

Study the design of the new pool. In the grid complete part B of the illustration by drawing the neighbor's pool as a mirror image of his own. Then complete Step B.

STEP A



STEP B How many lines of symmetry are in the illustration for Step A?_____

Explain how you can prove it._____

_____

_____

Task 4

When contractors began construction of Mr. Hurt's pool, it took several days to dig the hole before concrete could be poured. On Saturday, bulldozers began digging at 8:30 in the morning. Mr. Hurt had to leave for a dentist appointment at 10:45 a.m.

Now, complete steps A and B.

STEP A How long did the contractor dig on Saturday? _____

Show your work.

STEP B Mr. Hurt left the dentist office at 2:15 and returned home by 3:00. How long did it take to get home? _____

Explain how you decided._____

_____

_____

_____

_____

Task 5

Now that the pool has been completed, it's time to have some fun! Use the information gathered from Tasks 1-4 to describe your new pool to a best friend. Then invite him or her to your long awaited pool party. Think about the day and date the party will take place. Think about the time it will begin and end. Finally, think about how long the party will last.

Be sure to use correct grammar, punctuation, capitalization, and spelling.

Performance Rubric

Does the student demonstrate the ability to:

- sort a collection of shapes based on known attributes?
- identify angles equal to or greater than a right angle?
- identify congruent figures and lines of symmetry?
- construct a design using mirror symmetry?
- draw a design according to specifications?
- write a note to inform?
- validate logical thinking?
- communicate mathematically?

3 POINTS

- Responds to all parts of the task accurately.
- Uses the language of mathematics to communicate logically and effectively.
- Responds to all components of the writing prompt in a note to inform.

2 POINTS

- Responds to most parts of the task accurately.
- Uses the language of math to communicate logically and effectively.
- Responds to most components of the writing prompt in a note to inform.

1 POINT

- Responds to some parts of the task accurately.
- Uses some mathematics language.
- Responds to some components of the writing prompt in a note to inform.

NO SCORE

- Responds with many errors or makes no attempt.
- Uses little or no math language.
- Responds to few or no components of the writing prompt and the note to inform.